Upper Lapwai Creek
Monitoring Report 2001

Collection period (4/26/00 to 4/16/01)

Developed for:

Lewis Soil Conservation District
Winchester Lake Watershed Advisory Group
Idaho Soil Conservation Commission
Idaho State Department of Agriculture

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Technical Results Summary
CDM—ULC-01

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Acknowledgements

James Teply initiated the Upper Lapwai Creek (ULC) study and also carried out most of the fieldwork. David Horras helped James and myself with fieldwork for this project. Jefferson Davis of the Nez Perce Tribe, Chuck Pentzer of the Soil Conservation Commission, and several members of the Lewis Soil Conservation District provided valuable insight and encouragement that tremendously aided in the completion of this document.

Executive Summary

Water quality monitoring was performed on Upper Lapwai Creek (ULC) by the Idaho Association of Soil Conservation Districts (IASCD) from April 26, 2000 to April 16, 2001. Eight sites were selected to represent the ULC watershed with water quality sampling occurring every two weeks. Parameters measured were total suspended solids (TSS), nitrate+nitrite (NO_3+NO_2), total phosphorus (TP), and ortho-phosphate (OP). Other measurements include flow, turbidity, pH, specific conductance (Cond), total dissolved solids (TDS), dissolved oxygen (DO), % saturation (% Sat), and temperature (temp).

DO concentrations and water temperature only were problems at ULC sites just before the stream went dry. All pH values were found to be within the acceptable range throughout the monitoring period. TSS and turbidity measurements were overall very low in the entire watershed with the exception of one storm event in April. In that storm event, TSS concentrations approached 700 mg/L at site ULC-3, and 250 mg/L at site ULC-4. These data suggest that BMPs in the ULC-4 watershed are functioning to reduce sediment from entering waterways. The high TSS value observed at ULC-3 appears to be a result of Woodside Road, which transects the stream 300 yards upstream of this site. NO_2+NO_3 concentrations were observed to be high at site ULC-4 during the spring runoff period. These high nitrogen values were also elevated downstream at sites ULC-2 and ULC-3. There was one event during fall rains where the data suggest that nitrogen based fertilizer was mobilized due to an apparent overapplication of anhydrous ammonia. However, this seems to be an isolated event. Nitrate was elevated at all other sites during the spring runoff period and also elevated during July at ULC-5 and ULC-6. All total phosphorus values at sites ULC-1, ULC-6, ULC-7 and ULC-8 exceeded the recommended standard. These data suggest that nitrogen and phosphorus are entering the stream from the grazed pastures near ULC-6 and ULC-7. The majority of TP values at sites ULC-2, ULC-3, ULC-4, and ULC-5 also exceeded this standard. Phosphorus concentrations were relatively low at sites ULC-2 and ULC-3 just before Upper Lapwai Creek enters Winchester Lake. Strong correlations between stream discharge versus TSS, turbidity, TP, and NO_2+NO_3 were observed at all ULC sites except for ULC-1 below the spillway. This supports discharge as the driving factor in this watershed.

The leaking drainfield from the Winchester wastewater treatment facility seemed to be the greatest contributor of nitrogen and phosphorus in the entire Upper Lapwai Creek watershed at the time that this data was collected. However, it appears that this drainfield has been repaired. Also, dissolved oxygen concentrations dropped below the state standard below the dam because of dam leakage, which also has since been repaired. Further monitoring below the spillway by the Nez Perce Tribe will be important in determination of the extent and functionality of the drainfield and of the dam.

Introduction

Winchester Lake was created by the damming of its major tributary Upper Lapwai Creek in 1910. This lake drains an area of 7,800 acres and acts as a settling basin for the watershed. The Lake was originally created as a millpond for logging and then was acquired by the State of Idaho and Winchester State Park was later created. In the past two decades Winchester Lake has experienced severe eutrophication, algal blooms, fish kills and odors. Winchester Lake and major tributary Upper Lapwai Creek were both listed under the Clean Water Act 303 (d) list of impaired waterbodies primarily for elevated sediment, nutrient, and bacteria levels.

Monitoring Program

Water quality monitoring was performed on Upper Lapwai Creek (ULC) by the Idaho Association of Soil Conservation Districts (IASCD) from April 26, 2000 to April 16, 2001. Eight sites were selected to represent the ULC watershed with water quality with sampling occurring every two weeks (Figure 1). Laboratory analysis of nitrogen (N), phosphorus (P), and total suspended solids was performed by University of Idaho, Analytical Science Laboratories (UIASL) and bacteria samples were analyzed by Anatek Laboratories. Parameters measured were total suspended solids (TSS), nitrate+nitrite (NO_3+NO_2), total phosphorus (TP) and ortho-phosphate (OP). Other measurements include stream discharge, turbidity, pH, specific conductance (Cond), total dissolved solids (TDS), dissolved oxygen (DO), % saturation (% Sat), and temperature (temp). The data generated from this monitoring program will be used by IASCD, Soil Conservation Commission (SCC), Winchester Lake Watershed Advisory Group (WWAG), and the Lewis Soil Conservation District (LSCD) to determine loads within the stream, identify areas where best management practices (BMPs) would have the greatest benefit, provide baseline data prior to TMDL development, and identify changes as BMPs are implemented.

Site Descriptions

ULC-1 Site 50 yards below spillway of Winchester Lake dam
ULC-2 Site located on the main stem of Lapwai Creek 200 yards upstream of Winchester Lake.
ULC-3 Site located along the main stem of Lapwai Creek about 300 yards downstream of Woodside Road.
ULC-4 Lapwai Creek tributary upstream of Woodside Road.
ULC-5 Mainstem Lapwai Creek approximately 100 yards upstream of culvert on Woodside Road.
ULC-6 Site located along Lapwai Creek mainstem in grazed pasture.
ULC-7 Site located on Lapwai tributary in grazed pasture.
ULC-8 Site located above Mud Springs Reservoir.

Upper Lapwai Creek

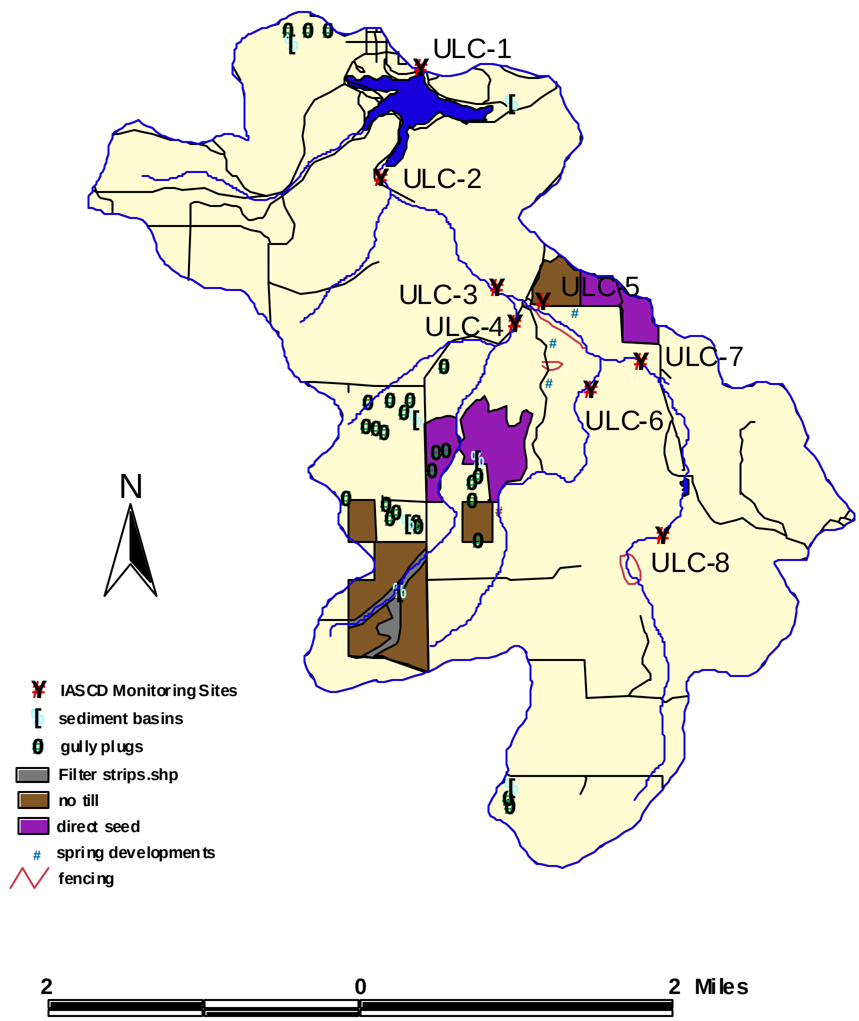

Figure 1. Map of the Upper Lapwai Creek Watershed with IASCD monitoring sites and implemented Best Management Practices.

Methods

Water Quality

A representative depth-integrated sample was collected at each site by collecting approximately 4 liters of stream water. Water samples were collected with a one-liter Nalgene bottle and transferred into a 2.5-gallon polyethylene churn sample splitter. The polyethylene churn splitter was rinsed with ambient water at each location prior to sample collection. The resultant composite sample was homogenized before filling the appropriate sample containers. Ortho-phosphate samples were filtered through a 0.45 µm GN-6 Gelman metricel filter. The resultant filtrate was transferred directly into the appropriate sample bottle. The filtration unit was thoroughly rinsed with deionized water and equipped with a new 0.45 µm filter at each sampling location. Water samples requiring preservation (Table 1) were transferred into preserved (H_2SO_4 pH <2) 500 mL sample containers. Water quality samples (TSS, NO_2+NO_3, TP, and OP) were analyzed at the UIASL in Moscow, Idaho.

Bacteriological samples (fecal coliform and *Escherichia coli* (*E. coli*)) were collected directly from the thalweg into sterile sample containers. The samples were shipped to Anatek Labs in Spokane, Washington for analysis. Most probable number (MPN) multiple tube fermentation was used to determine bacteria levels in the water sample.

Table 1 displays a list of parameters, sample sizes, preservation, holding times, and analytical methods. All sample containers were labeled with waterproof markers with the following information: station location, sample identification, date of collection, and time of collection. Samples were placed on ice and transported to the laboratory the same day as collection. Chain-of-Custody forms accompanied each sample shipment.

Table 1. Water Quality Parameters

Parameters	Sample Size	Preservation	Holding Time	Method
Non Filterable Residue (TSS)	1L	Cool 4°C	7 Days	EPA 160.2
Nitrogen(NO_3/NO_2)	60 mL	Cool 4°C, H_2SO_4 pH < 2	28 Days	EPA 353.2
Total Phosphorus	100 mL	Cool 4°C, H_2SO_4 pH < 2	28 Days	EPA 365.4
Ortho Phosphate	100 mL	Filtered , Cool 4°C	24 Hours	EPA 365.2
Fecal Coliform	100 mL	Cool 4°C	30 Hours	SM9221
Escherichia coli	100 mL	Cool 4°C	30 Hours	MPN

Field Measurements

At each location, field measurements of dissolved oxygen, specific conductance, pH, temperature, turbidity, and total dissolved solids were conducted. Calibration of all field equipment will be in accordance with the manufacturer's specifications. Table 2 contains a listing of field measurements, equipment and calibration techniques.

Table 2. Field Measurements

Parameters	Instrument	Calibration
Dissolved Oxygen	YSI Model 55	Ambient air calibration
Temperature	YSI Model 55	Centigrade thermometer
Conductance & TDS	Orion Model 115	Specific Conductance (25^oC standard)
pH	Orion Model 210A	Standard buffer (7,10) bracketing for linearity
Turbidity	Hach Model 2100P	Formazin Primary Standard

All field measurements were recorded in a field notebook along with any pertinent observations about the site, including weather conditions, flow rates, personnel on site, and any problems observed that might affect water quality.

Stream Discharge Measurements

Flow measurements were collected at each site using a Marsh McBirney Flow Mate Model 2000 flow meter. The six-tenths depth method (0.6 of the total depth from the surface of the water surface) was used. At each monitoring station, a transect line was established across the width of the drain/creek at an angle perpendicular to the flow for the calculation of cross-sectional area. The discharge was computed by summing the products of the partial areas (partial sections) of the flow cross-sections and the average velocities for each of those sections. Stream discharge was reported as cubic feet per second (cfs).

Quality Assurance and Quality Control (QA/QC)

The UIASL utilizes methods approved and validated by the Environmental Protection Agency (EPA). A method validation process, including precision and accuracy performance evaluations and method detection limit studies, are required of ASL Standard Methods. Method performance evaluations include quality control samples, analyzed with a batch to ensure sample data integrity. Internal laboratory spikes and duplicates are part of ASL's quality assurance program. Laboratory QA/QC results generated from this project can be provided upon request.

QA/QC procedures from the field-sampling portion of this project included a duplicate and a blank sample (one set per sampling day). The field blanks consisted of laboratory-grade deionized water, transported to the field and poured off into the appropriate sample container. The blank sample was used to determine the integrity of the field teams handling of samples, the condition of the sample containers and deionized water supplied by the laboratory, and the accuracy of the laboratory methods. Duplicates were obtained by filling two sets of sample containers with homogenized composite water from the same sampling site. The duplicate and blank samples were not identified as such to laboratory personnel to ensure laboratory precision.

Data Handling

All of the field and analytical data generated from each survey were submitted to ISDA for review. Each batch of data from a survey was reviewed to insure that all necessary observations, measurements, and analytical results were properly recorded. The analytical results were reviewed for completeness and accuracy. Any suspected errors were investigated and resolved, if possible. The data were stored electronically and are available to any interested entity.

Results and Discussion

Descriptive data is presented in Table 3. This table includes maximum, minimum, and average values for each measured parameter as well as the number and percentage of sampling events that exceeded state water quality standards and EPA criteria.

Dissolved Oxygen

The State of Idaho standard for DO states that dissolved oxygen must exceed 6.0 mg/L at all times for cold water biota. ULC-5, ULC-6, and ULC-7 each had one sampling event where DO was observed to drop below 6 mg/L (Figure 2, Table 3). ULC-8 dropped below the DO criteria on two occasions of the events sampled (Table 3). DO (mg/L) dropped below the recommended criteria at ULC-1 fourteen times, consisting of 61% of the sampling events (Table 3). Site ULC-1 shows a minimum %Sat of 14% with mean and median values of 41% (Table 3). The low observances of site ULC-1 probably is directly related to its position below the spillway of Winchester Lake in times of low or absent discharge from the lake outlet. In addition, prior to the renovation of the dam, water was believed to seep through the dam and deposit below the spillway. If the water were seeping from deep stratified areas in the lake DO concentrations would be expected to be extremely low. The dam was renovated in fall of 2001 and continued water quality monitoring from the Nez Perce Tribe will reveal if this trend reverses.

Water Temperature

The State of Idaho water quality temperature standard for support of cold water biota is less than 22^{o}C. No exceedance of instantaneous water temperature was observed at ULC-1, ULC-2, ULC-3, ULC-4, or ULC-7 (Figure 3, Table 3). This standard was exceeded three times at ULC-5, five times at ULC-6, and two times at ULC-8 (Figure 3, Table 3). However, ULC-4, ULC-6, ULC-7, and ULC-8 were observed to go dry from July to September.

Specific Conductance and Total Dissolved Solids

No standards or criteria exist that set limits of conductance or TDS. Specific conductance and TDS measurements that were performed during the sampling period were all observed to be within the typical range of values for the Idaho Panhandle (Figure 4, Table 3).

Table 1. Maximum, minimum, median, and average values for each measured parameter at IASCD Upper Lapwai Creek Monitoring locations. # exceedance/ year equals the number of sampling events when each respective value exceeded EPA or State of Idaho water quality standards and critera. % exceedance equals the percentage of sampling events when each respective value exceeded EPA or State of Idaho water quality standards and critera.

		D.O. (mg/L)	% Sat (%)	Temp (^oC)	Specific Cond µS/cm @ 25^oC	TDS (mg/L)	pH (H^+)	Turbidity (NTU)	TSS (mg/L)	$NO_3 + NO_2$ (mg/L)	TP (mg/L)	OP (mg/L)	Fecal Coliform (MPN/100mL)	E-Coli (MPN/100mL)	Flow (cfs)
	ULC-1														
Maximum		10.9	88%	14.8	299.0	148.0	7.7	33.1	44.0	2.3	1.0	0.5	80.0	40.0	8.9
Minimum		1.5	15%	1.7	136.3	65.0	7.2	3.4	0.0	0.5	0.2	0.1	0.0	0.0	0.1
Average		5.1	41%	8.5	211.1	107.3	7.4	13.6	12.5	1.3	0.5	0.2	9.0	4.0	1.3
Median		4.2	41%	9.1	220.0	108.0	7.4	13.5	8.0	1.2	0.5	0.2	0.0	0.0	0.4
# exceedance		14.0		0.0			0.0	1.0		23.0	23.0	22.0	0.0	0.0	
% exceedance		61%		0%			0%	4%		100%	100%	96%	0%	0%	
	ULC-2														
Maximum		12.6	114%	16.0	201.0	106.0	8.3	49.3	75.0	1.8	0.3	0.1	5000.0	5000.0	10.8
Minimum		8.2	78%	0.6	129.4	64.0	7.3	5.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
Average		10.7	92%	9.2	168.8	87.3	8.0	19.0	14.3	0.5	0.1	0.1	352.2	346.5	2.0
Median		10.6	91%	8.6	173.9	92.0	8.1	16.1	8.6	0.2	0.1	0.1	30.0	20.0	0.4
# exceedance		0.0		0.0			0.0	4.0		6.0	12.0	2.0	1.0	5.0	
% exceedance		0%		0%			0%	24%		35%	71%	12%	6%	29%	
	ULC-3														
Maximum		12.4	113%	20.0	189.5	100.0	8.6	393.0	660.0	4.7	1.1	0.2	5000.0	5000.0	6.6
Minimum		8.9	80%	0.3	77.2	39.0	7.4	7.1	0.0	0.3	0.1	0.0	0.0	0.0	0.0
Average		10.6	96%	11.7	157.7	81.6	8.1	42.1	54.2	1.1	0.2	0.1	470.0	450.8	1.2
Median		10.4	94%	12.6	167.0	86.0	8.2	17.3	15.5	1.0	0.1	0.1	80.0	80.0	0.2
# exceedance		0.0		0.0			0.0	5.0		13.0	10.0	3.0	1.0	6.0	
% exceedance		0%		0%			0%	31%		81%	63%	19%	6%	38%	
	ULC-4														
Maximum		11.7	96%	21.3	213.0	111.0	8.6	135.0	230.0	3.8	0.5	0.1	3000.0	1600.0	12.7
Minimum		6.4	70%	0.4	122.6	58.0	7.5	12.9	7.0	0.1	0.1	0.1	0.0	0.0	0.0
Average		9.6	85%	10.5	171.5	88.2	8.1	39.8	39.8	1.1	0.2	0.1	646.6	453.9	1.5
Median		10.1	87%	8.4	163.8	83.0	8.2	32.2	16.0	0.3	0.2	0.1	230.0	40.0	0.1
# exceedance		0.0		0.0			0.0	7.0		5.0	9.0	1.0	3.0	5.0	
% exceedance		0%		0%			0%	64%		45%	82%	9%	27%	45%	
	ULC-5														
Maximum		13.7	156%	22.8	208.0	99.0	9.2	66.9	120.0	1.4	0.4	0.2	2400.0	2400.0	10.5
Minimum		5.8	55%	0.3	107.8	50.0	7.3	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average		10.3	97%	13.1	153.7	79.8	7.9	18.5	19.0	0.4	0.2	0.1	507.5	497.9	1.2
Median		9.6	98%	12.5	152.5	82.0	7.8	15.2	12.0	0.4	0.1	0.1	140.0	95.0	0.2
# exceedance		1.0		3.0			0.0	2.0		9.0	12.0	2.0	3.0	7.0	
% exceedance		6%		18%			0%	12%		53%	71%	12%	18%	41%	
	ULC-6														
Maximum		12.4	124%	28.2	197.8	105.0	8.5	59.1	76.0	1.0	0.3	0.2	9000.0	9000.0	6.1
Minimum		5.8	72%	0.1	100.9	53.0	7.3	11.1	4.0	0.0	0.1	0.1	0.0	0.0	0.0
Average		9.0	89%	16.8	145.4	75.7	7.9	23.5	26.9	0.3	0.2	0.1	1272.7	1270.0	0.8
Median		8.5	91%	16.0	148.6	79.0	8.0	20.5	24.5	0.0	0.3	0.1	500.0	500.0	0.1
# exceedance		1.0		5.0			0.0	2.0		3.0	12.0	4.0	4.0	7.0	
% exceedance		8%		42%			0%	17%		25%	100%	33%	33%	58%	
	ULC-7														
Maximum		12.5	122%	14.9	163.9	86.0	8.7	34.9	231.0	0.7	0.7	0.5	16000.0	16000.0	3.1
Minimum		5.6	56%	0.1	88.6	42.0	7.3	13.3	5.0	0.0	0.1	0.1	0.0	0.0	0.0
Average		9.2	80%	10.0	134.6	69.0	7.8	26.7	55.9	0.2	0.3	0.2	2864.3	2861.0	0.7
Median		9.3	79%	12.9	148.6	78.0	7.6	26.4	27.0	0.0	0.2	0.1	30.0	20.0	0.3
# exceedance		1.0		0.0			0.0	5.0		2.0	7.0	4.0	3.0	3.0	
% exceedance		14%		0%			0%	71%		29%	100%	57%	43%	43%	
	ULC-8														
Maximum		13.6	129%	27.2	170.5	91.0	8.9	45.1	53.0	0.7	0.3	0.1	1100.0	900.0	1.5
Minimum		5.7	69%	4.9	87.6	44.0	7.3	14.5	5.0	0.0	0.1	0.1	0.0	0.0	0.0
Average		8.4	84%	16.7	130.6	68.2	8.0	24.2	20.5	0.3	0.2	0.1	406.6	326.6	0.5

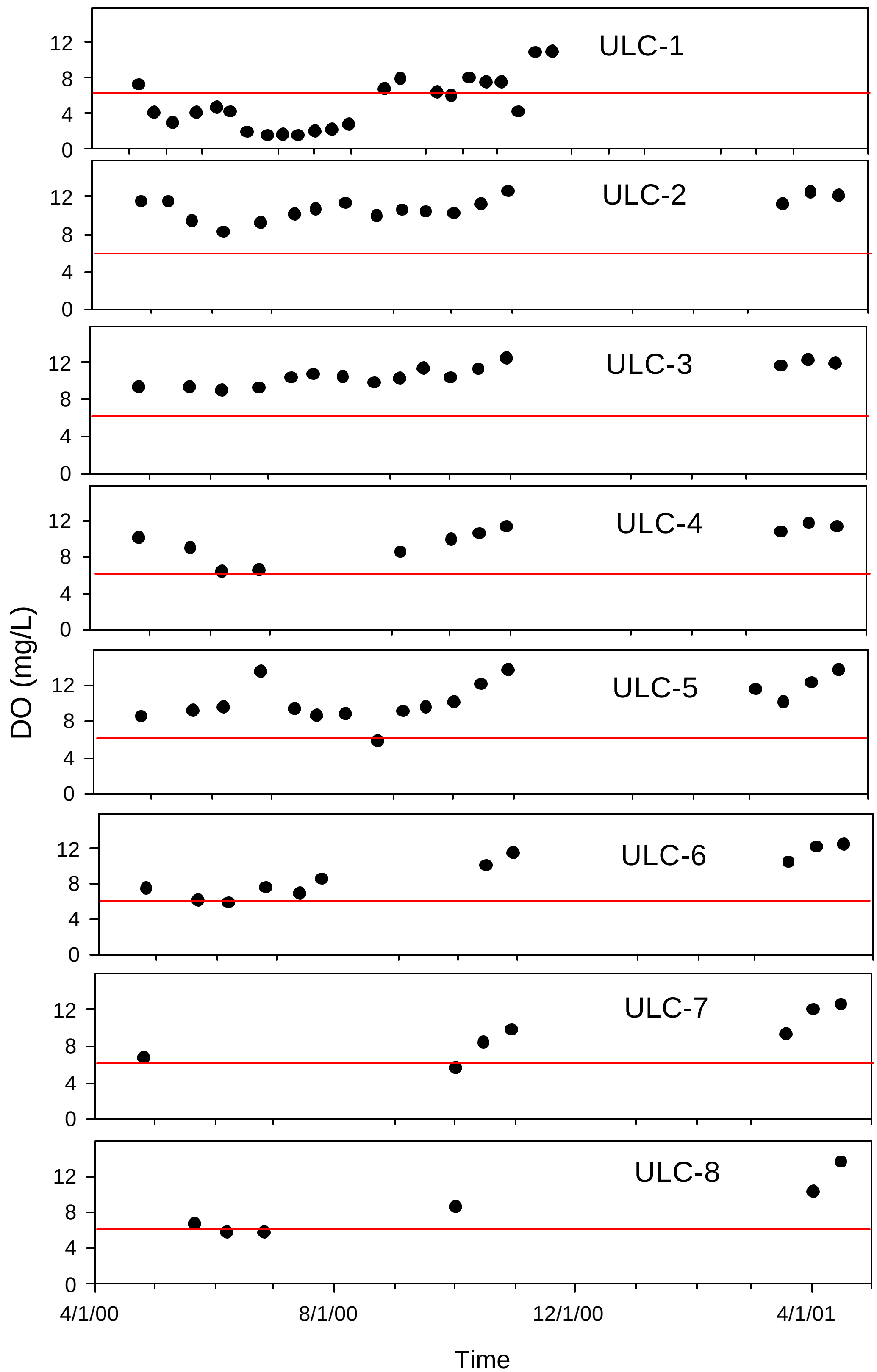

Figure 2. Dissolved oxygen data collected for Upper Lapwai Creek from April 26, 2000 to April 7, 2001.

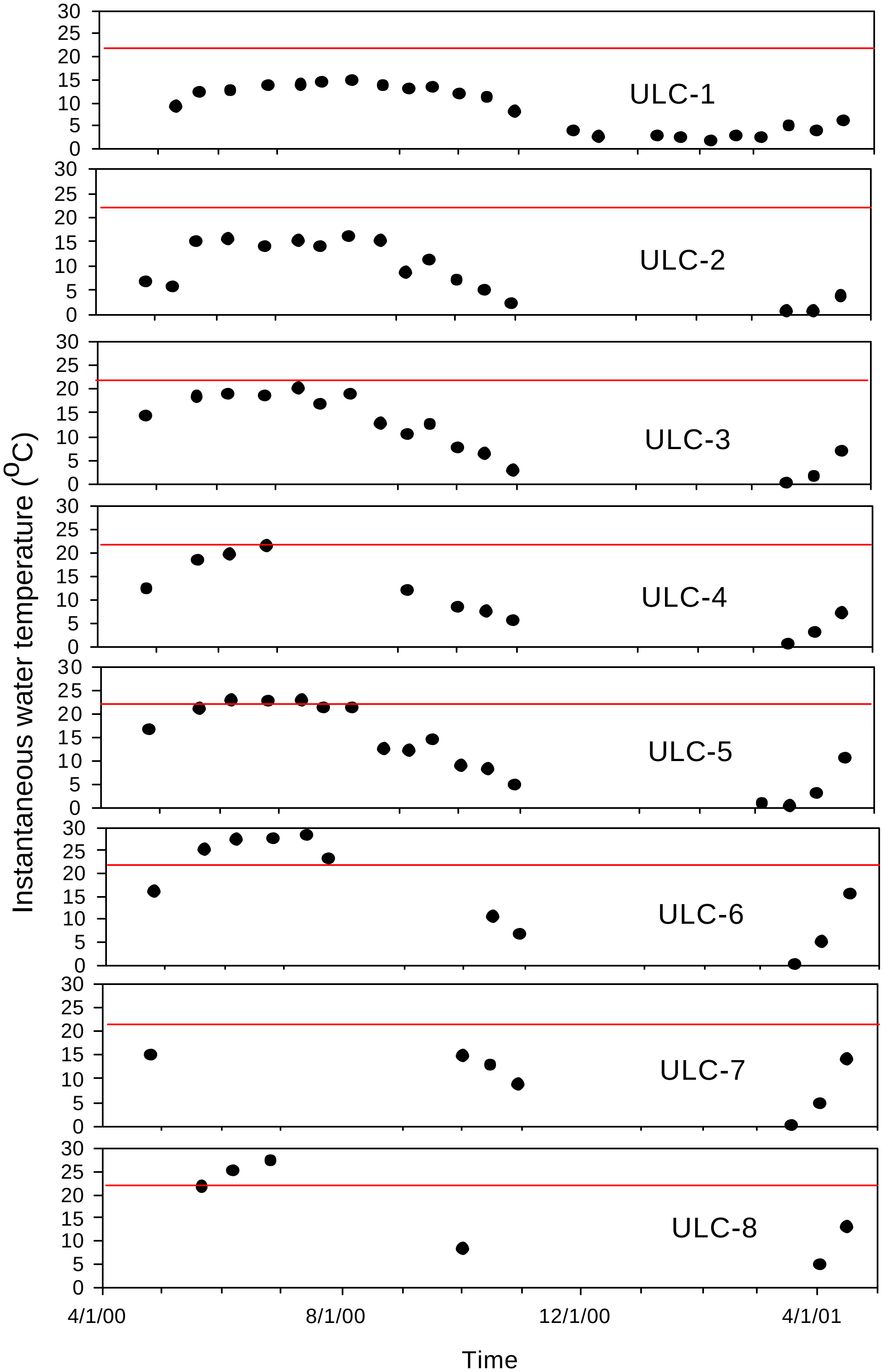

Figure 3. Instantaneous water temperature data collected for Upper Lapwai Creek from April 26, 2000 to April 17, 2001.

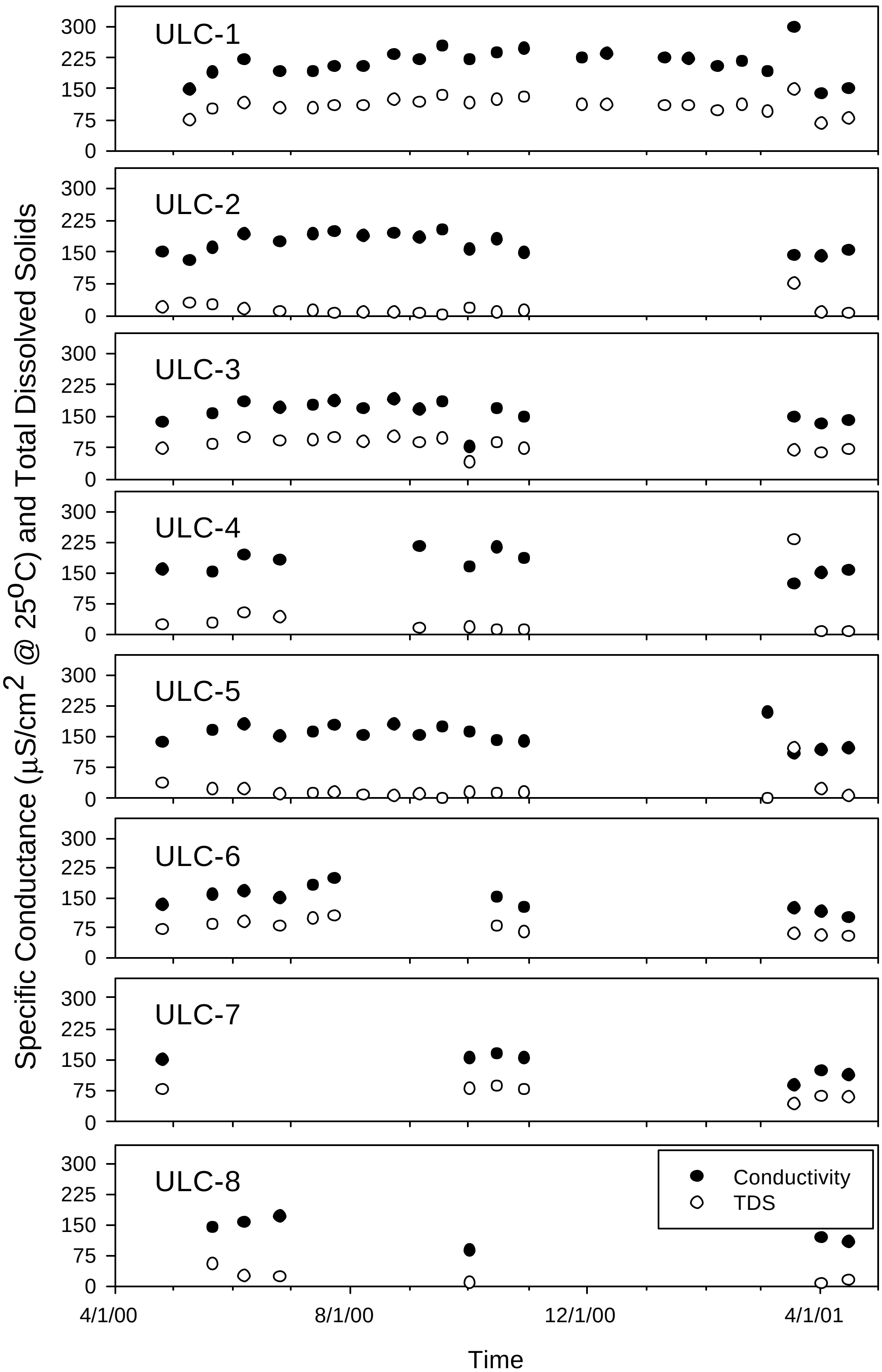

Figure 4. Specific conductance and total dissolved solids data collected for Upper Lapwai Creek from April 26, 2000 to April 17, 2001.

pH

The State of Idaho water quality standard for pH states that H^+ concentration must fall between 6.5 and 9.5. All measured pH values during the sampling period were observed to be within the acceptable range (Figure 5, Table 3).

Turbidity and Total Suspended Solids

The State of Idaho water quality standard for Turbidity states that measurements should not exceed 25 NTU for more than 10 consecutive days. No numerical standard exists for TSS, but significant direct associations ($p<0.001$) were found between the two measurements at all sites. In addition significant direct correlations were found between TSS and stream discharge at all sites with the exception of ULC-1. This is because of the location of site ULC-1 below the dam. TSS and turbidity measurements were overall very low in the entire watershed with the exception of one storm event in April 2001 (Figure 6, Table 3). In that storm event, TSS concentrations approached 700 mg/L at site ULC-3, and 250 mg/L at site ULC-4 (Figure 6). Sites ULC-5 and ULC-4 are located around 300 m upstream of ULC-3. Woodside Road appears to be the only anthropogenic influence between these sites. It appears that a proportion (<1/2) of the sediment is coming from the ULC-4 watershed as agricultural runoff. However, the high sediment values at ULC-3 suggest that sediment is entering the stream from Woodside Road.

Nitrogen (NO_3+NO_2)

The literature suggests that NO_3 values in excess of 0.30 mg/L could contribute to excessive plant production and eutrophication. All measured values at site ULC-1 exceeded the recommended nitrogen criterion (Figure 7, Table 3). This appears to be a result of the former drainfield of the wastewater treatment facility, which supposedly has been repaired. Nitrate concentrations were at or below 0.3 most of the year at the lake inlet (ULC-2). In March and April a nitrate spike was observed at sites ULC-2, ULC-3, and ULC-4 (Figure 7). The data suggest that this is coming from agriculture in the ULC-4 watershed. It is a common practice in the area for farmers to apply anhydrous ammonia in the fall. This form of nitrogen can later convert to nitrates and nitrites and become extremely mobile in the spring. NO_3+NO_2 concentrations seem to be scattered above and below the recommended standard at sites ULC-5, ULC-6, ULC-7, and ULC-8 but seem to spike during the spring and fall rain events. This seems logical since this area contains pastureland, which accumulates manure in the summer and is then flushed in rain events.

Phosphorus (Total Phosphorus and Ortho-Phosphate)

Ortho-phosphate refers the dissolved or soluble portion of particles less than 0.45 μm. Total phosphorus refers to the total amount of P suspended in the water column (<0.45 + >0.45). The EPA Gold Book criterion for total phosphorus concentrations is 0.100 mg/L for streams and rivers not discharging directly into lakes or reservoirs. All TP concentrations at sites ULC-1, ULC-6, ULC-7 and ULC-8 exceeded the recommended standard (Figure 8, Table 3). The majority of TP values at sites ULC-2, ULC-3, ULC-4, and ULC-5 also exceeded this standard (Figure 8, Table 3). Total Phosphorus concentration were relatively low at sites ULC-2 and ULC-3 just before Upper Lapwai Creek enters Winchester Lake (Figure 8). The lake outlet site (ULC-1) showed TP values that were higher than any other site (Figure 8). This suggests that

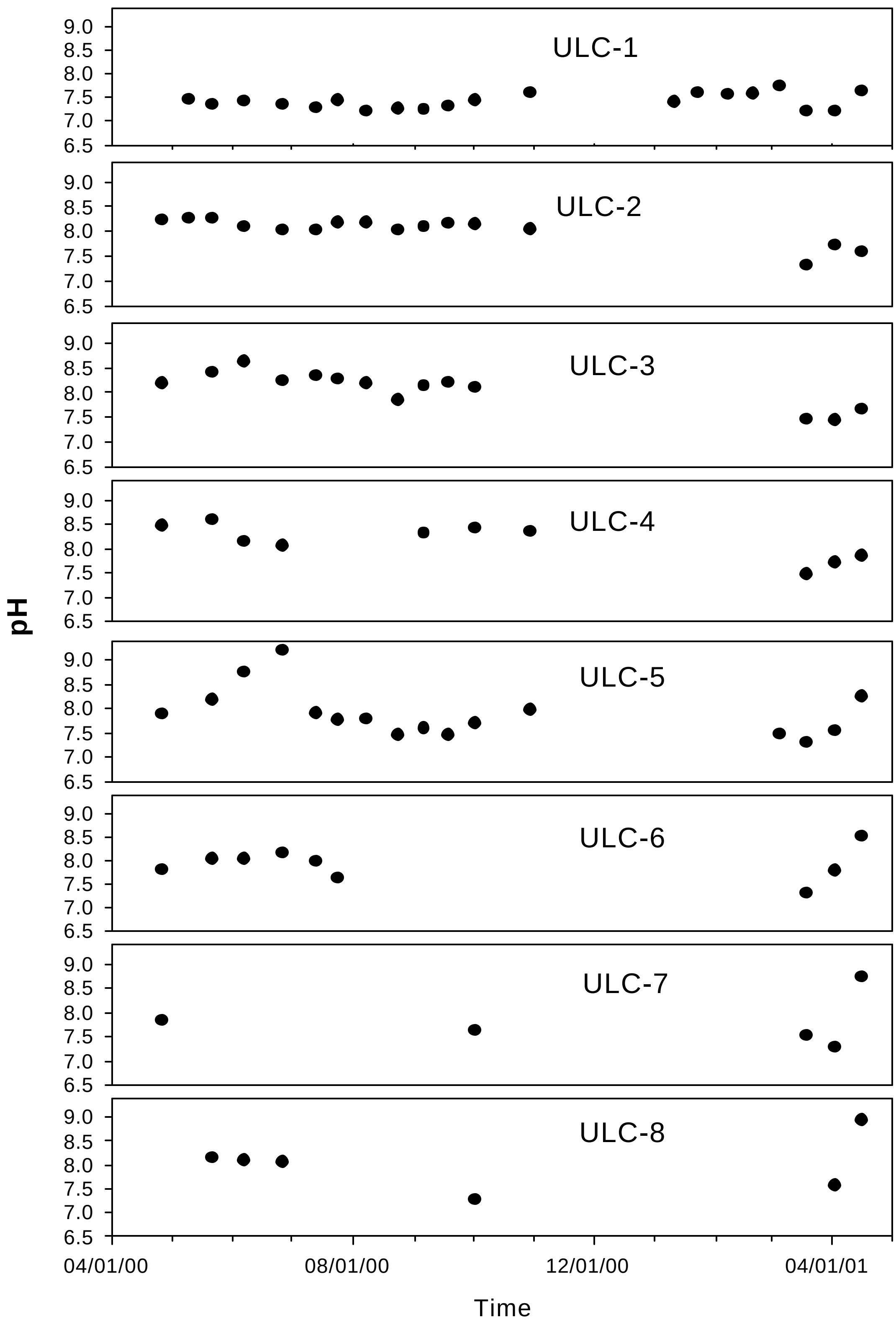

Figure 5. pH measurements collected for Upper Lapwai Creek from April 26, 2000 to April 17, 2001.

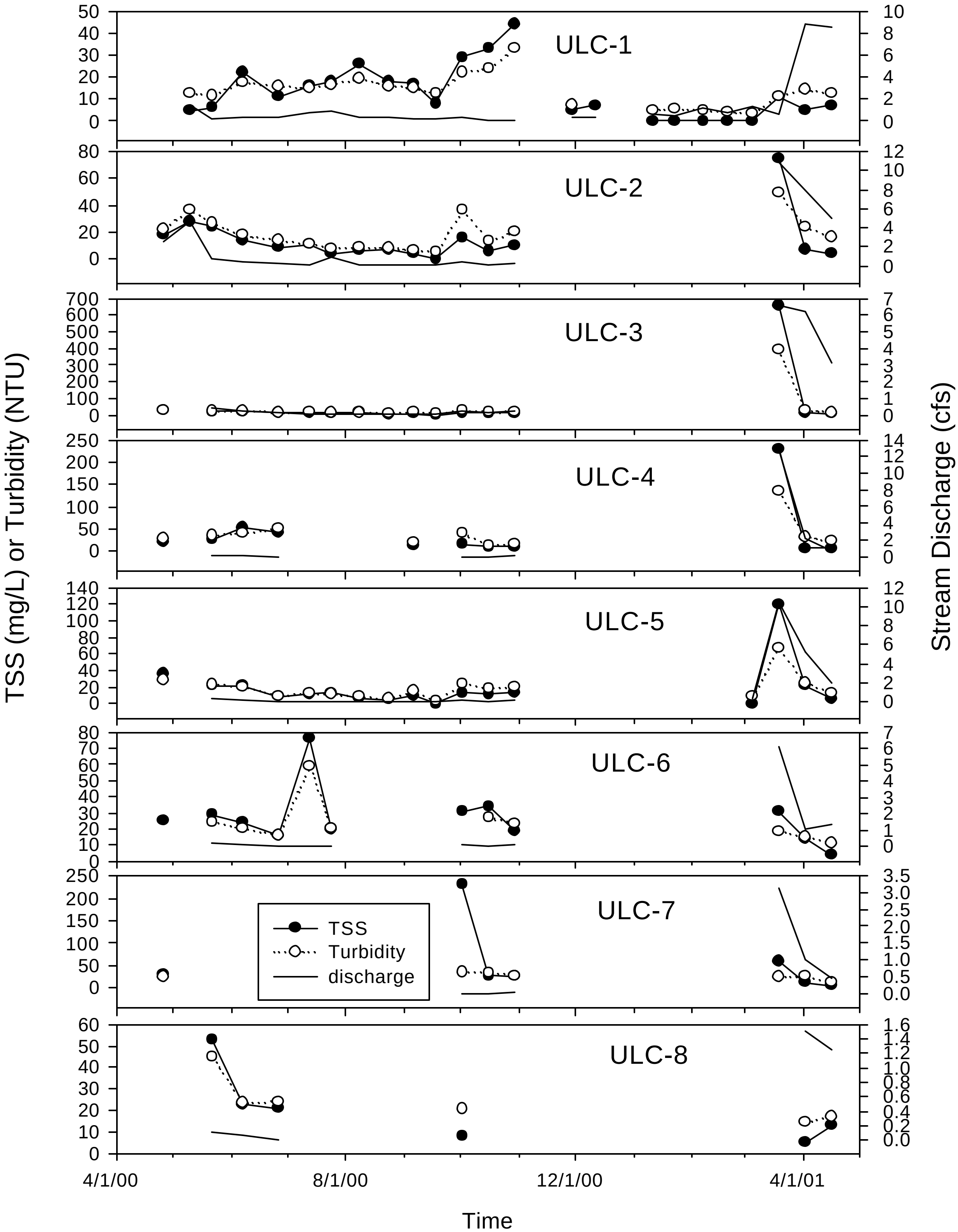

Figure 6. Total suspended solids (TSS), Turbidity, and discharge collected for Upper Lapwai Creek from April 26, 2000 to April 17, 2001.

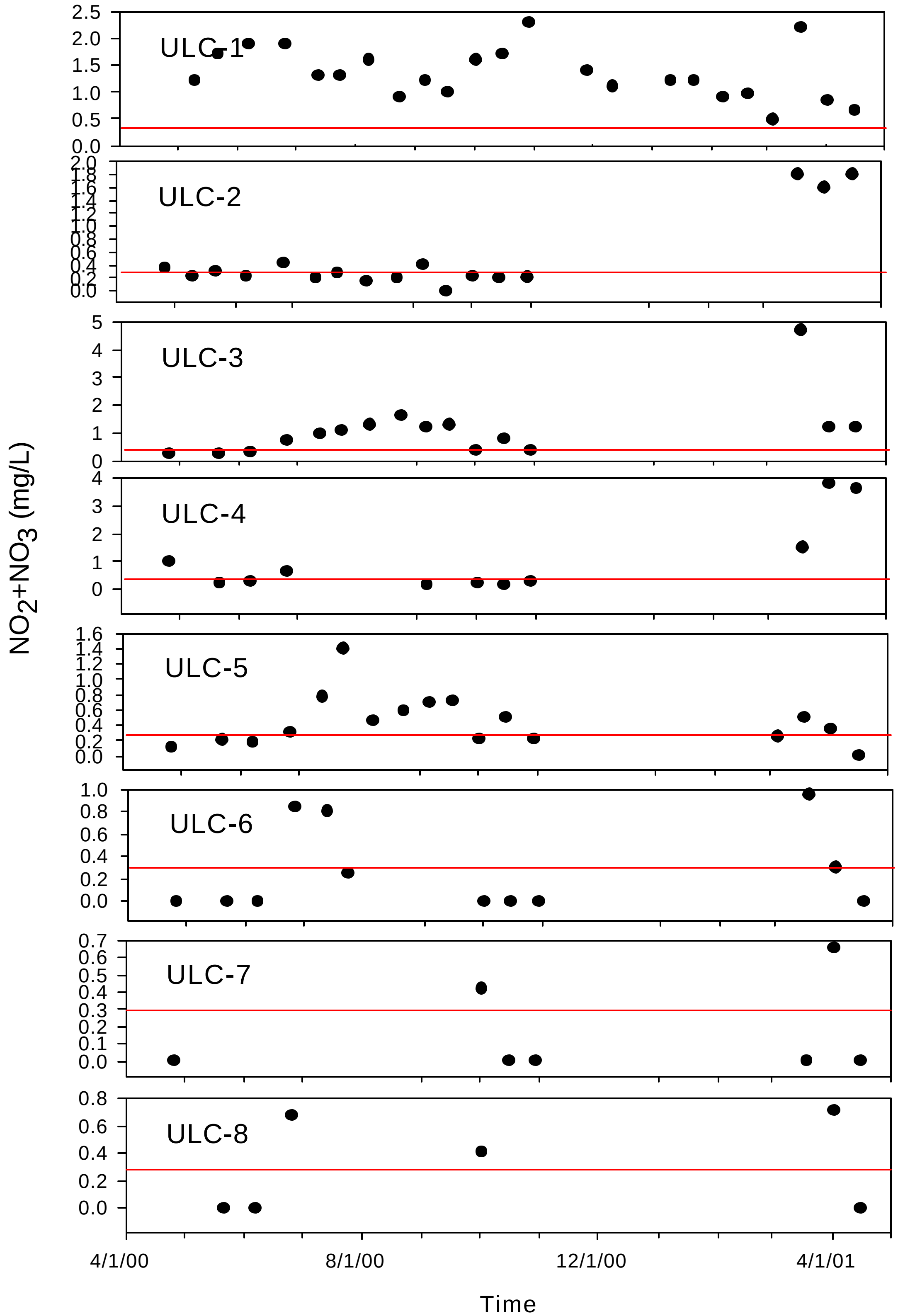

Figure 7. Nitrate + Nitrite data collected for Upper Lapwai Creek from April 26, 2000 to April 17, 2001.

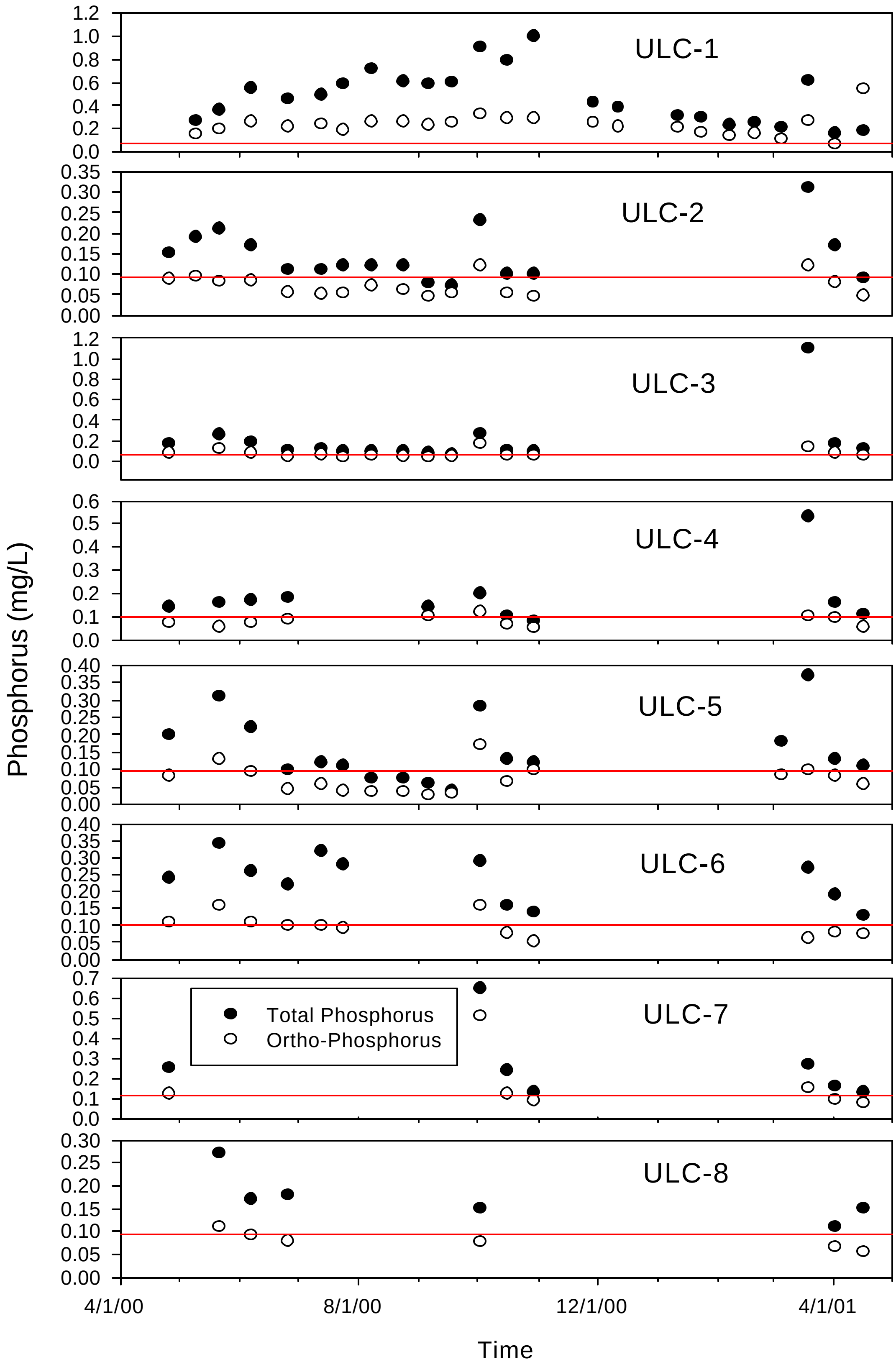

Figure 9. Total and othro phosphorus data collected for Upper Lapwai Creek from April 26, 2000 to April 17, 2001.

phosphorus is being released through lake processes, from effects from Winchester Lake State Park, or from the drain field from the wastewater treatment facility that was in operation during the time of this monitoring. Site ULC-4 is positioned below the majority of the agricultural landuse in this watershed and phosphorus values were observed to be relatively low (Figure 8). Sites ULC-5, ULC-6, ULC-7, and ULC-8 are positioned on or just downstream of grazed pastureland. Total phosphorus concentrations between 0.1 and 0.4 mg/L at all of these locations with most of the high values occurring during spring runoff and fall rain (Figure 8, Table 3). Significant positive correlations were observed between TP and TSS at all sites except for ULC-6 and ULC-7. Which suggests that phosphorus at these sites is probably coming from cattle at these two sites.

Bacteria (*E. coli* and fecal coliform)

The standard for *E. coli* is that concentrations should not exceed 126 organisms/100 mL, which should be based on a geometric mean. The *E. coli* standard for primary contact is not to exceed 406 organisms/100 mL at any time and not to exceed 576 organisms/100 mL at any time for secondary contact. The standard for fecal coliform states that water samples should not exceed 500 organisms/100 mL at any time for primary contact and should not exceed 800 organisms/100mL at any time for secondary contact. Fecal coliform and E. coli concentrations were low at sites ULC-1, ULC-2, and ULC-3 except for one outlying event that occurred in November (Table 3, Figure 9). Bacteria levels at sites ULC-4, ULC-5, ULC-6, ULC-7, and ULC-8 all exceeded the recommended standards for E. coli and fecal coliform from July through November (Figure 9). Bacteria concentrations at these sites are probably contributed from cattle grazing in the adjacent pastureland.

Conclusions

DO concentrations and water temperature only were problems at ULC sites just before the stream went dry. All pH values were found to be within the acceptable range throughout the monitoring period. TSS and turbidity measurements were overall very low in the entire watershed with the exception of one storm event in April. In that storm event, TSS concentrations approached 700 mg/L at site ULC-3, and 250 mg/L at site ULC-4. These data suggest that BMPs in the ULC-4 watershed are functioning to reduce sediment from entering waterways. NO_2+NO_3 concentrations were observed to be high at site ULC-4 during the spring runoff period. The high TSS value observed at ULC-3 appears to be a result of Woodside Road, which transects the stream 300 yards upstream of this site. These high nitrogen values were also elevated downstream at sites ULC-2 and ULC-3. There was one event during fall rains where the data suggest that nitrogen based fertilizer was mobilized due to an apparent overapplication of anhydrous ammonia. However, this seems to be an isolated event. Nitrate was elevated at all other sites during the spring runoff period and also elevated during July at ULC-5 and ULC-6. All total phosphorus values at sites ULC-1, ULC-6, ULC-7 and ULC-8 exceeded the recommended standard. These data suggest that nitrogen and phosphorus are entering the stream from the grazed pastures near ULC-6 and ULC-7. The majority of TP values at sites ULC-2, ULC-3, ULC-4, and ULC-5 also exceeded this standard. Phosphorus concentrations were relatively low at sites ULC-2 and ULC-3 just before Upper Lapwai Creek enters Winchester Lake. Strong correlations between stream discharge versus TSS, turbidity, TP, and NO_2+NO_3

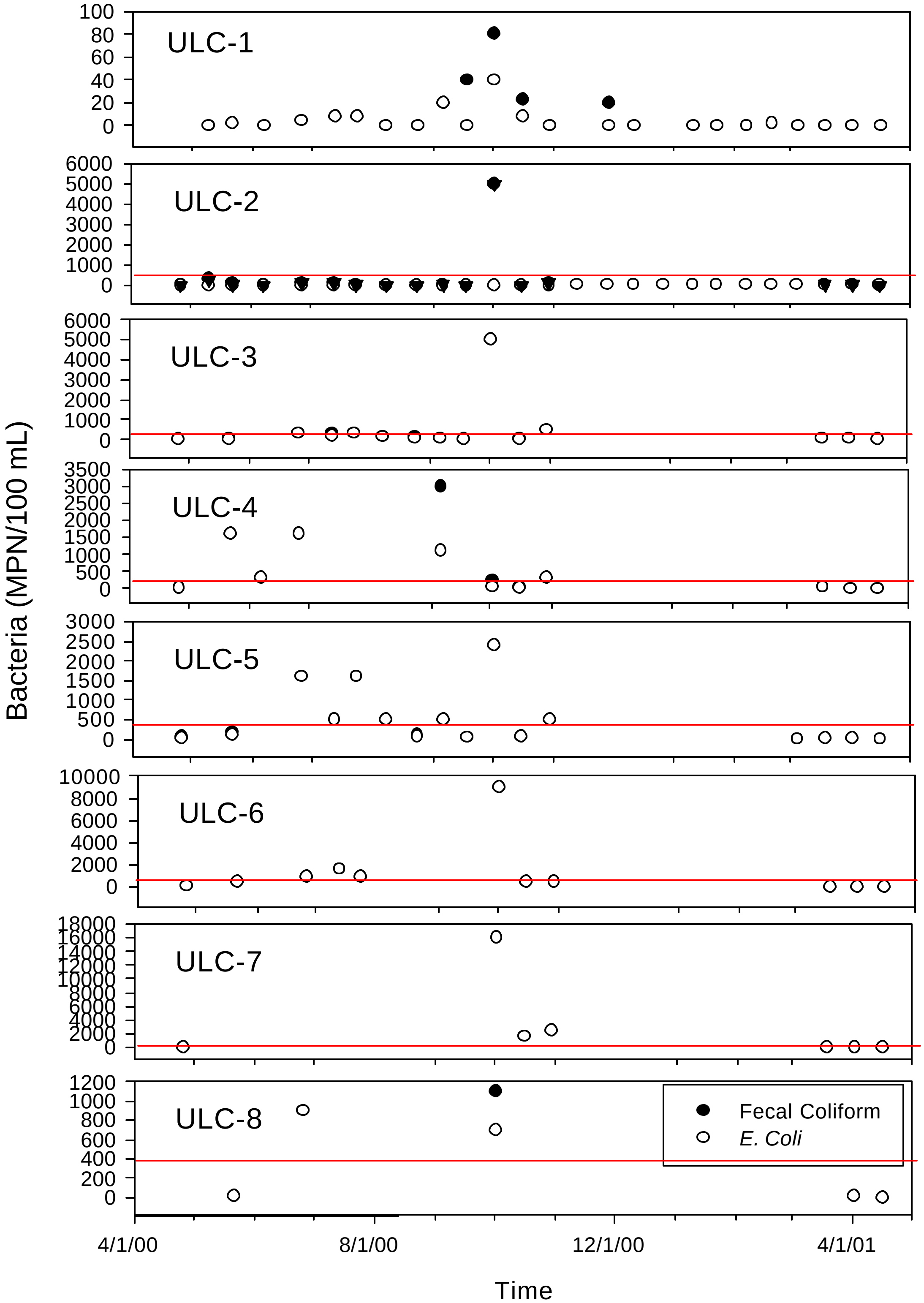

Figure 9. Bacteria data (fecal coliform and *E. coli)* collected for Upper Lapwai Creek from April 26, 2000 to April 17, 2001.

were observed at all ULC sites except for ULC-1 below the spillway. This supports discharge as the driving factor in this watershed.

The leaking drainfield from the Winchester wastewater treatment facility seemed to be the greatest contributor of nitrogen and phosphorus in the entire Upper Lapwai Creek watershed at the time that this data was collected. However, it appears that this drainfield has been repaired. Also, dissolved oxygen concentrations dropped below the state standard below the dam because of dam leakage, which also has since been repaired. Further monitoring below the spillway by the Nez Perce Tribe will be important in determination of the extent and functionality of the drainfield and of the dam.

Recommendations

The WWAG, LSCD, ISCC, and the NP tribe should look to implement BMPs in the pastureland in the upper watershed. Riparian buffer strips, fenced waterways, and vegetation would tremendously aid in repairing stream health in the upper watershed. Various groups (Moeller 1986, Entranco 1990, Wertz 1996, and NP Tribe 2001) have conducted long term monitoring since 1985 on the lake inlet. This site would be ideal to measure long-term effects of BMP implementation on water quality. I recommend installing a permanent monitoring station and using water level recorders to collect continuous discharge data at this site on the lake inlet. In addition, dataloggers could be used to monitor turbidity continuously. Since the pollutants of concern are largely driven by stream discharge, the continuous discharge and turbidity could be used with past analytical data to create a model specific to the Upper Lapwai Creek watershed to monitor conditions on a long term time scale (10-20 years). Rapid bioassessments, and seasonal water quality sampling could continue as funding were available and be incorporated into the model.

Future monitoring in the upper ULC watershed should focus on pasture areas, stream bank assessment and sources of bacteria. County officials should closely monitor private septic systems so that these systems do not negatively impact water quality. Fall application of anhydrous ammonia as well as spring applications should be closely monitored to prevent excess fertilizer from entering Lapwai Creek. The NP Tribe is currently conducting monitoring on three sites in the upper ULC watershed. This information will prove valuable in determination of the functionality of the repaired drainfield from the wastewater treatment facility and the former leaking dam. Overall, the ULC project was a success. The monitoring plan was followed and quality assurance/control procedures were successful.

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